METHOD AND SYSTEM FOR PROVIDING CALIBRATION OF AN ANALYTE SENSOR IN AN ANALYTE MONITORING SYSTEM

RELATED APPLICATION

The present application is a continuation of U.S. patent application Ser. No. 12/624,377 filed Nov. 23, 2009, now U.S. Pat. No. 8,376,945, which is a continuation of U.S. patent application Ser. No. 11/463,582 filed Aug. 9, 2006, now U.S. Pat. No. 7,653,425, entitled "Method and System for Providing Calibration of an Analyte Sensor in an Analyte Monitoring System", the disclosures of each of which are incorporated herein by reference for all purposes.

BACKGROUND

Analyte, e.g., glucose monitoring systems including continuous and discrete monitoring systems generally include a small, lightweight battery powered and microprocessor controlled system which is configured to detect signals proportional to the corresponding measured glucose levels using an electrometer, and RF signals to transmit the collected data. One aspect of certain analyte monitoring systems include a transcutaneous or subcutaneous analyte sensor configuration which is, for example, partially mounted on the skin of a subject whose analyte level is to be monitored. The sensor cell may use a two or three-electrode (work, reference and counter electrodes) configuration driven by a controlled potential (potentiostat) analog circuit connected through a contact system.

To obtain accurate data from the analyte sensor, calibration is necessary. Typically, blood glucose measurements are periodically obtained using, for example, a blood glucose meter, and the measured blood glucose values are used to calibrate the sensors. Indeed, the patient must calibrate each new analyte sensor using for example, capillary blood glucose measurements. This may be inconvenient for the patient.

In view of the foregoing, it would be desirable to have a method and system for calibrating analyte sensors of an analyte monitoring system that does not inconveniently require periodic blood glucose measurements for sensor calibration.

SUMMARY OF THE INVENTION

In view of the foregoing, in accordance with the various embodiments of the present invention, there is provided a method and system for providing substantially automatic and substantially real time calibration of analyte sensors for use in an analyte monitoring system.

These and other objects, features and advantages of the present invention will become more fully apparent from the following detailed description of the embodiments, the appended claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a block diagram of a data monitoring and management system for practicing one embodiment of the present invention;

FIG. **2** is a block diagram of the transmitter unit of the data monitoring and management system shown in FIG. **1** in accordance with one embodiment of the present invention;

FIG. **3** is a block diagram of the receiver/monitor unit of the data monitoring and management system shown in FIG. **1** in accordance with one embodiment of the present invention;

FIG. **4** is a flowchart illustrating the analyte sensor sensitivity estimation procedure in accordance with one embodiment of the present invention;

FIG. **5** is a flowchart illustrating the analyte sensor parameter estimation procedure in accordance with one embodiment of the present invention;

FIG. **6** is a flowchart illustrating an analyte sensor parameter estimation procedure in accordance with another embodiment of the present invention;

FIG. **7**A illustrates the transmission of the control signal from the transmitter processor in accordance with one embodiment of the present invention;

FIG. **7**B illustrates the measured response to the control signal from the transmitter processor shown in FIG. **7**A in accordance with one embodiment of the present invention;

FIG. **8** is a tabular illustration of a lookup table for sensor sensitivity for use with the calibration procedure in accordance with one embodiment of the present invention; and

FIG. **9** is a flowchart illustrating the analyte sensor sensitivity estimation procedure in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION

As described in detail below, in accordance with the various embodiments of the present invention, there is provided a method and system for determining sensor sensitivity of an analyte sensor which may be used to calibrate the analyte sensor in the analyte monitoring system. In particular, within the scope of the present invention, there is provided method and system for automatically calibrating subcutaneous or transcutaneously positioned analyte sensors such that the frequency of capillary blood glucose measurement for calibration of the sensors may be minimized.

More specifically, FIG. **1** illustrates a data monitoring and management system such as, for example, analyte (e.g., glucose) monitoring system **100** in accordance with one embodiment of the present invention. The subject invention is further described primarily with respect to a glucose monitoring system for convenience and such description is in no way intended to limit the scope of the invention. It is to be understood that the analyte monitoring system may be configured to monitor a variety of analytes, e.g., lactate, and the like.

Analytes that may be monitored include, for example, acetyl choline, amylase, bilirubin, cholesterol, chorionic gonadotropin, creatine kinase (e.g., CK-MB), creatine, DNA, fructosamine, glucose, glutamine, growth hormones, hormones, ketones, lactate, peroxide, prostate-specific antigen, prothrombin, RNA, thyroid stimulating hormone, and troponin. The concentration of drugs, such as, for example, antibiotics (e.g., gentamicin, vancomycin, and the like), digitoxin, digoxin, drugs of abuse, theophylline, and warfarin, may also be monitored.

The analyte monitoring system **100** includes a sensor **101**, a transmitter unit **102** coupled to the sensor **101**, and a receiver unit **104** which is configured to communicate with the transmitter unit **102** via a communication link **103**. The receiver unit **104** may be further configured to transmit data to a data processing terminal **105** for evaluating the data received by the receiver unit **104**. Moreover, the data processing terminal in one embodiment may be configured to receive data directly from the transmitter unit **102** via a communication link **106** which may optionally be configured for bi-directional communication.

Only one sensor **101**, transmitter unit **102**, receiver unit **104**, communication link **103**, and data processing terminal **105** are shown in the embodiment of the analyte monitoring